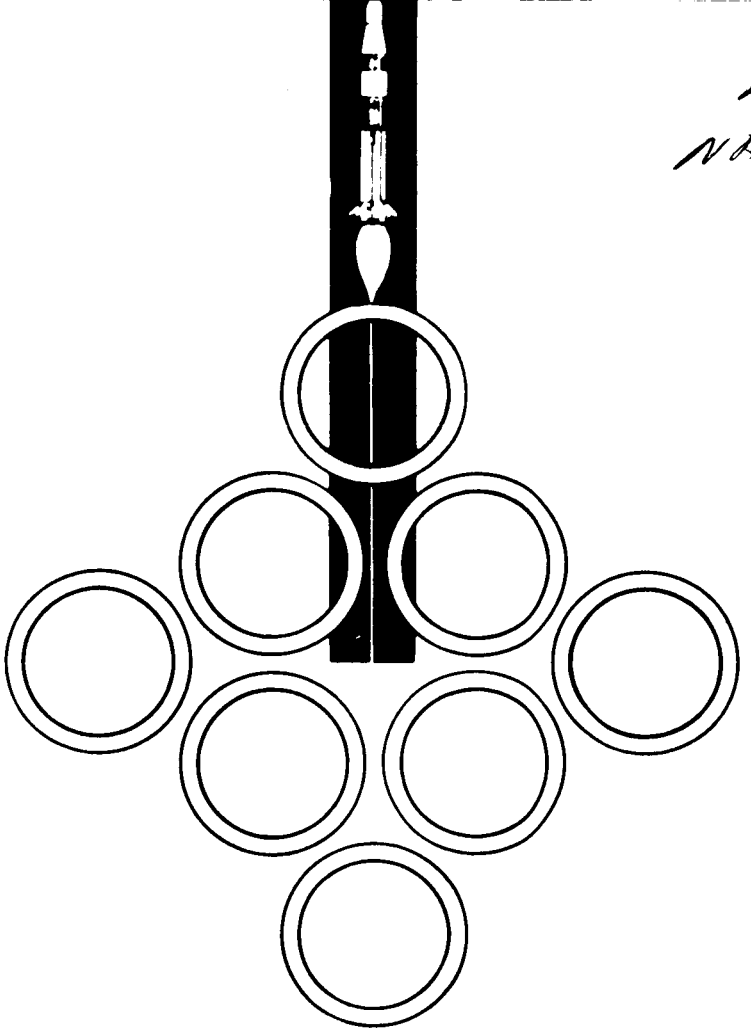

ENGINEERING DEPARTMENT

TECHNICAL REPORT

TR-RE-CCSD-FO-1027-3

March 24, 1967

SATURN IB PROGRAM

TEST REPORT
FOR

RELIEF VALVE, 6 BY 8 INCH

Manning, Maxwell, and Moore Part Number Type 1905 QC/L3

NASA Drawing Number 75M12930 LRV-7

SPACE DIVISION CHRYSLER CORPORATION

TEST REPORT

FOR

RELIEF VALVE, 6 BY 8 INCH

Manning, Maxwell, and Moore Part Number Type 1905 QC/L3

NASA Drawing Number 75M12930 LRV-7

ABSTRACT

This report presents the results of tests performed on three specimens of Relief Valve 75M12930 LRV-7. The following tests were performed.

1. Receiving Inspection
2. Functional
3. High Temperature
4. Flow
5. Surge and Response
6. Cycle
7. Proof Pressure

The performance of each test specimen was in accordance with the specification requirements of NASA Drawing 75M12930 LRV-7 throughout the test program.

TEST REPORT

FOR

RELIEF VALVE, 6 BY 8 INCH

Manning, Maxwell, and Moore Part Number Type 1905 QC/L3

NASA Drawing Number 75M12930 LRV-7

March 24, 1967

CHRYSLER CORPORATION SPACE DIVISION - NEW ORLEANS, LOUISIANA

FOREWORD

The tests reported herein were conducted for the John F. Kennedy Space Center by Chrysler Corporation Space Division (CCSD), New Orleans, Louisiana. This document was prepared by CCSD under contract NAS 8-4016, Part VII, CWO 271620.

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Relief Valve, 75M12930 LRV-7, 6 by 8-inch

CHECK SHEET

FOR

RELIEF VALVE, 45-PSIG, 6- BY 8-INCH

MANUFACTURER: Manning, Maxwell, and Moore
MANUFACTURER'S PART NUMBER: Type 1905 QC/L3
NASA PART NUMBER: 75M12930 LRV-7
TESTING AGENCY: Chrysler Corporation Space Division, New Orleans, Louisiana
AUTHORIZING AGENCY: NASA KSC

I.	FUNCTIONAL REQUIREMENTS	
	A. OPERATING MEDIUM:	Liquid oxygen
	B. CRACKING PRESSURE:	45 psig
	C. RESEATING PRESSURE:	44 psig
II.	CONSTRUCTION	
	A. CAP, BASE, AND BONNET:	ASTM-A-351 Grade CF8
	B. NOZZLE AND DISC:	ASTM-A-182 Grade F-304 SS
	C. DISC RETAINER:	Inconel
	D. GASKETS:	Soft iron
	E. SPRING:	AISI 302 SS
III.	ENVIRONMENTAL CHARACTERISTICS	
	A. TEMPERATURE RANGE:	Ambient to -320°F
IV.	LOCATION AND USE:	Relief Valve 75M12930 LRV-7 is used to prevent over pressurization of the inner LOX storage tank at Launch Complex 37.

TEST SUMMARY
RELIEF VALVE, 6 BY 8 INCH
75M12930 LRV-7

Environment	Units	Operational Boundary	Test Objective	Test Results	Remarks
Receiving Inspection	3	Comply with NASA Drawing 75M12930	To determine compliance with NASA and vendor drawings and examine for defects and poor workmanship.	Satisfactory	None
Functional Test	3	Cracking Pressure 45(+3,-0) psig. Reseat pressure 85% of cracking minimum. Leakage zero.	Measure cracking pressure, reseat pressure, and leakage at ambient and during simulated rainfall conditions.	Satisfactory	C.P.-45 psig R.P.-44 " Leakage - zero.
High Temperature Test	2	Operate during and after exposure to +160°F.	Functionally test each specimen at +160°F.	Satisfactory	C.P.-45 psig R.P.-44 " Leakage - zero.
Flow Test	2	NA	Measure flow of GN_2 from cracking pressure to 110% of cracking pressure.	Satisfactory	Flow rate 24 to 35 lb/sec.
Surge and Response Test	2	37 to 50 psig	Measure time differential between 45 psig and valve cracking.	Satisfactory	Specimen response was within 100 ms.
Cycle test	2	37 psig to 105% of cracking pressure. 1000 cycles.	Determine if specimen operation is impared by cycling.	Satisfactory	No change in specimen operation.
Proof Pressure Test	3	68 psig for 30 minutes.	Determine if pressure causes leakage or distortion.	Satisfactory	No leakage or distortion.

SECTION I

INTRODUCTION

1.1 SCOPE

This report presents the results of tests that were performed to determine if 6-by 8-inch Relief Valve 75M12930 LRV-7 meets the operational and environmental requirements for John F. Kennedy Space Center Launch Complex 37. A summary of the test results is presented on page **viii.**

1.2 ITEM DESCRIPTION

1.2.1 Three specimens of Relief Valve 75M12930 LRV-7 were tested. The valve is used at Launch Complex 37 to prevent over pressurization of the inner LOX tank. Relief Valve 75M12930 LRV-7 is manufactured by Manning, Maxwell, and Moore as vendor part number type 1905 QC/L3. The valve has flanged connections with a 6-inch inlet and an 8-inch outlet. Incorporated in the design are a relief pressure adjustment, a locking device, and a protective cap. Cracking pressure is 45 psig and reseating pressure is 44 psig.

1.3 APPLICABLE DOCUMENTS

The following documents contain the test requirements for Relief Valve 75M12930 LRV-7.

a. KSC-STD-164(D), Standard Environmental Test Methods for Ground Support Equipment Installation at Cape Kennedy

b. NASA Drawing 75M12930 LRV-7

c. Test Plan CCSD-FO-1027-1R

d. Test Procedure TP-RE-CCSD-FO-1027-2R

SECTION II

RECEIVING INSPECTION

2.1 TEST REQUIREMENTS

The specimens shall be visually and dimensionally inspected for conformance with the applicable specifications prior to testing.

2.2 TEST PROCEDURE

A visual and dimensional inspection was performed to determine compliance with NASA drawing 75M12930 LRV-7 and the applicable vendor drawing to the extent possible without disassembly of the specimens. At the same time the specimens were inspected for poor workmanship and manufacturing defects.

2.3 TEST RESULTS

Each specimen complied with NASA Specification 75M12930 LRV-7 and Vendor Drawing 1900 Q/L3. No evidence of poor workmanship or manufacturing defects were observed.

2.4 TEST DATA

The data presented in table 2-1 were recorded during the inspection.

Table 2-1. Specimen Nomenclature and Dimensions

Item	Relief Valve
Manufacturer	Manning, Maxwell, and Moore
Type	1905 QC/L3
Set Pressure	45 psi
Mounting Flange	6-inch ASA
Outlet Flange	8-inch ASA
Height (overall)	41 inches
Weight	430 pounds
Serial Numbers	
Specimen 1	TB 95278
Specimen 2	TB 95279
Specimen 3	TB 95280

SECTION III

FUNCTIONAL TEST

3.1 TEST REQUIREMENTS

3.1.1 The specimen shall be pressurized to 105 per cent of the cracking pressure; the pressure shall then be reduced to zero. Three such cycles shall be performed.

3.1.2 The inlet port of the specimen shall be pressurized to 35 psig with GN_2 at -300°F and the specimen temperature shall be allowed to stabilize. The specimen shall be inspected for leakage; no internal or external leakage is allowed. The inlet pressure shall be increased until cracking occurs (45 + 3, -0 psig) and the cracking pressure shall be recorded. The inlet pressure shall be increased to 105 per cent of the cracking pressure and then reduced to zero. The reseating pressure (85 per cent of cracking pressure) shall be recorded. This procedure shall be performed five times.

3.1.3 The specimen shall be returned to room ambient temperature.

3.1.4 During the initial functional test only, the specimen shall be subjected to a simulated rainfall atmosphere. The simulated rain shall be applied at a rate of 1 inch per hour and shall impinge on the specimen at an angle of 30 degrees in respect to the longitudinal axis of the specimen when the specimen is mounted in a vertical position. The simulated rainfall shall be applied for a period of 30 minutes.

Using GN2 at -300°F, the specimen inlet shall be pressurized to 105 per cent of cracking pressure and flow shall be allowed for 10 seconds or until the valve seat temperature stabilizes at cryogenic conditions. Cracking pressure and reseating tests as prescribed in 3.1.2 shall be performed three times while the specimen temperature is stabilized at cryogenic conditions. The specimen outlet port shield (figure 3-2) shall be installed on the specimen prior to and shall remain in place throughout this portion of the functional test.

3.2 TEST PROCEDURE

3.2.1 Each specimen was installed as shown in figures 3-1 and 3-2, using the equipment listed in table 3-1.

3.2.2 It was determined that all connections were tight, all gauges were installed and operating properly, and all hand valves were closed.

3.2.3 Hand valves 3 and 5 were opened.

3.2.4 By adjusting regulator 4, the specimen inlet was pressurized until cracking was indicated by the appearance of bubbles in the water bath 11. The cracking pressure was recorded. The pressure was increased until 105 per cent of cracking pressure was indicated on gage 7.

3.2.5 Regulator 4 was readjusted to zero outlet pressure and specimen reseating pressure as indicated on gage 7 was recorded.

3.2.6 Hand valve 8 was opened to vent the specimen pressure to zero.

3.2.7 The procedures described in 3.2.4 through 3.2.6 were repeated 3 times.

3.2.8 Hand valve 8 was closed.

3.2.9 By adjusting regulator 4, the specimen was pressurized to 35 psig with GN_2 at -300°F. The specimen temperature was allowed to stabilize at cryogenic conditions.

3.2.10 Graduated cylinder 10 was connected to the specimen outlet port. The specimen was checked for internal leakage. No leakage was observed.

3.2.11 Graduated cylinder 10 was disconnected.

3.2.12 The specimen was inspected for external leakage. No leakage was observed.

3.2.13 By readjusting regulator 4, the specimen inlet pressure was increased until cracking occurred. The cracking pressure was recorded. The inlet pressure was increased until 105 per cent of the cracking pressure was indicated on gage 7.

3.2.14 Hand valve 5 was closed and reseating pressure recorded.

3.2.15 The procedures described in 3.2.9 through 3.2.14 were repeated five times.

3.2.16 Hand valve 8 was opened to vent the specimen inlet pressure to zero.

3.2.17 Hand valves 3 and 8 were closed.

3.2.18 Regulator 4 was readjusted to zero outlet pressure.

3.2.19 The specimen was allowed to return to room ambient temperature.

3.2.20 During the initial functional test only, the specimen was subjected to a simulated rainfall atmosphere by spraying the specimen with water at a rate of one inch per hour. The spray was directed toward the specimen at an angle of 30 degrees in respect to the specimen longitudinal axis when the specimen was mounted in a vertical position (Figures 3-3 and 3-4).

3.2.21 The spray was maintained for 30 minutes. The procedures described in 3.2.22 through 3.2.25 were performed while the specimen was in the simulated rainfall atmosphere.

3.2.22 Hand valves 3 and 5 were opened.

3.2.23 By adjusting regulator 4, the specimen inlet was pressurized with GN_2 at -300°F until 105 per cent of cracking pressure was reached. Flow of the GN_2 at -300°F was allowed until the temperature of the specimen seat was stabilized at cryogenic temperature.

3.2.24 By readjusting regulator 4, the specimen pressure was reduced to 35 psig.

3.2.25 Cracking pressure, and reseating pressure were monitored on gauge 7.

3.2.26 The specimen was vented, and allowed to return to room ambient conditions.

3.3 TEST RESULTS

Each specimen demonstrated satisfactory accuracy for cracking and reseating pressure. No leakage was observed for either specimen at 35 psig. No deviation in cracking or reseating pressures was observed during the simulated rainfall conditions.

3.4 TEST DATA

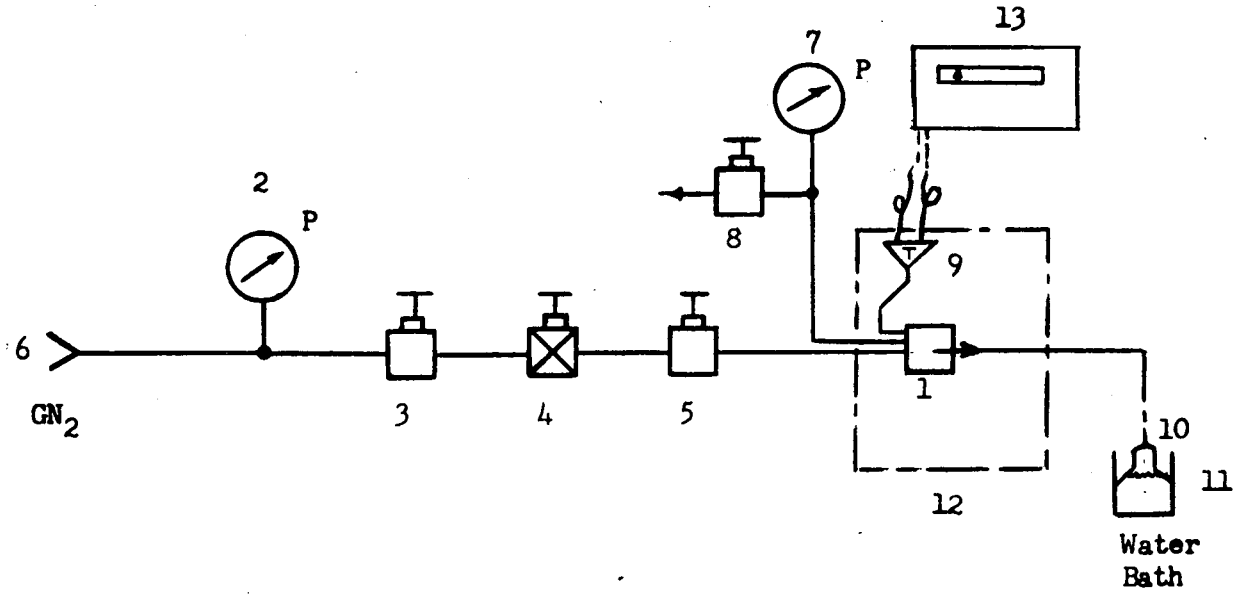
The data presented in table 3-2 were recorded during the initial tests.

Table 3-1. Functional Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Manning, Maxwell, and Moore	Type 1905 QC/L3	TB 95278 TB 95279 TB 95280	6-by 8-inch relief valve
2	Pressure Gage	Marsh	NA	95-1138-B	0-to 100-psig ±0.5% FS Cal date 11/9/66
3	Hand Valve	Stockham	NA	E5-612-PT	1-inch
4	Pressure Regulator	Stockham	400w	NA	300-psig inlet 150-psig outlet
5	Hand Valve	Stockham	NA	E5-608-PP	1/2 inch
6	GN_2 Supply	Laboratory Source	NA	NA	60-psig
7	Pressure Gage	Marsh	NA	95-1095-B	0-to 100-psig ±0.5% FS Cal date 11/9/66
8	Hand Valve	Stockham	NA	E5-609-PP	1/4-inch
9	Thermocouple	Honeywell	NA	NA	Copper constantan
10	Graduated Cylinder	NA	NA	NA	
11	Water Bath	NA	NA	NA	
12	Environmental Chamber	CCSD	NA	NA	Rain test only
13	Temperature Indicator	West	NA	08-113 95-1350 B	Cal Date 11/9/66

Table 3-2. Initial Functional Test Data

	Specimen 1	Specimen 2	Specimen 3
Cracking Pressure (psig)	45 44 45 45 45	44 44 45 45 45	45 45 44 45 45
Reseating Pressure (psig)	44 43 44 44 43	43 43 44 44 44	43 44 43 44 44
Leakage at 35 psig	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0



Note: All lines 1 inch.
Refer to table 3-1 for item identification.

Figure 3-1. Functional Test Schematic

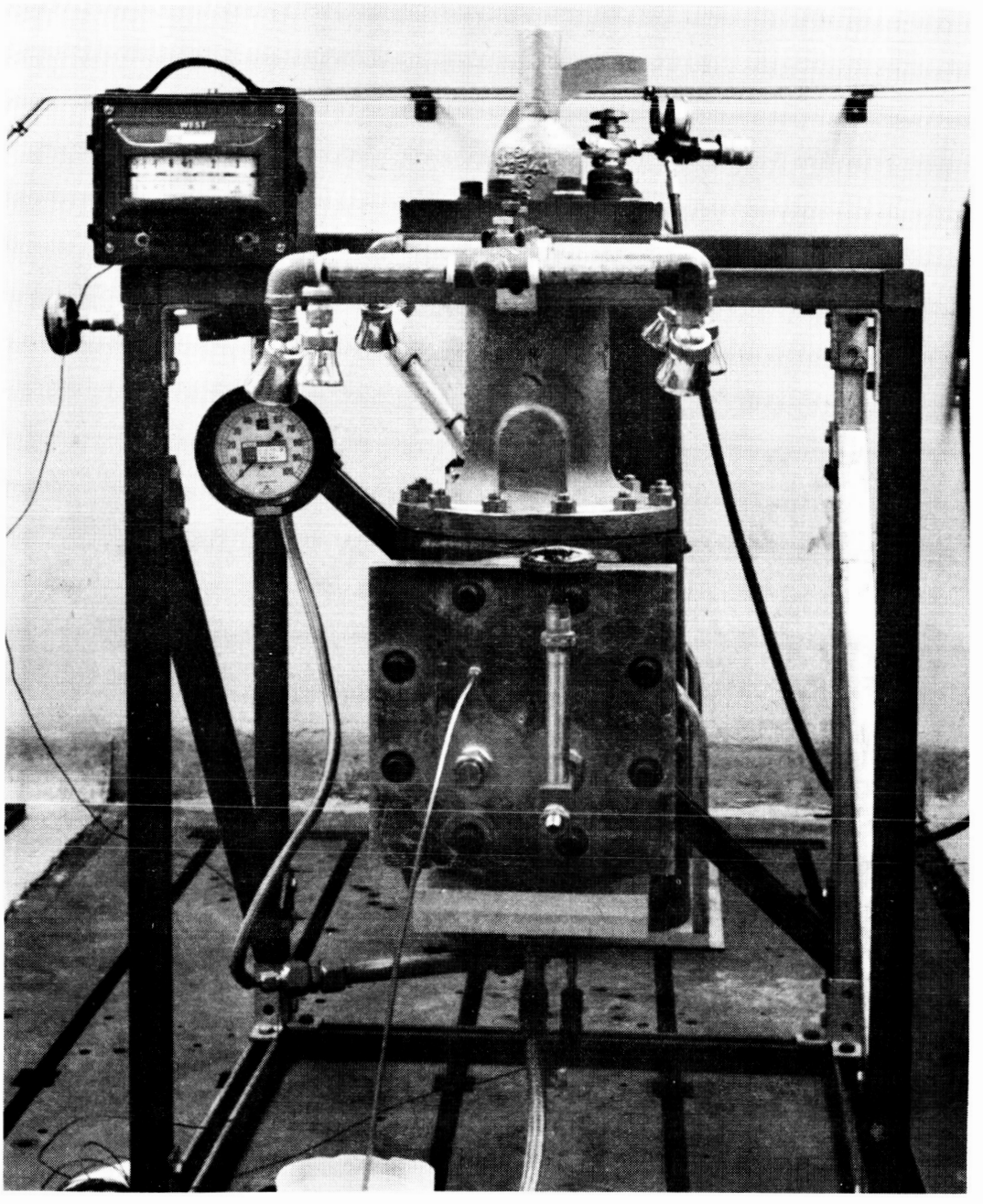


Figure 3-2. Functional Test Setup

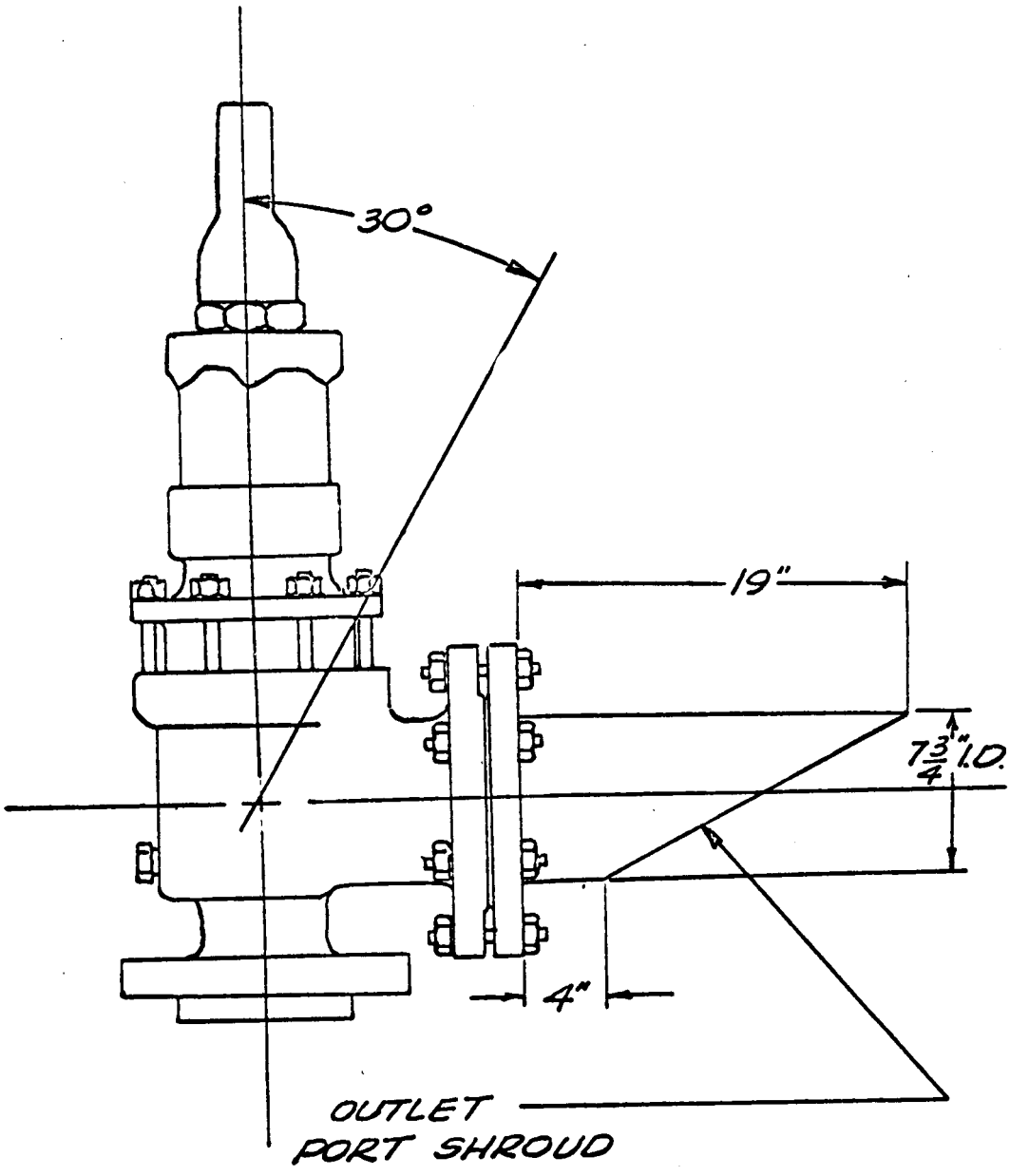


Figure 3-3. Specimen with Outlet Shroud

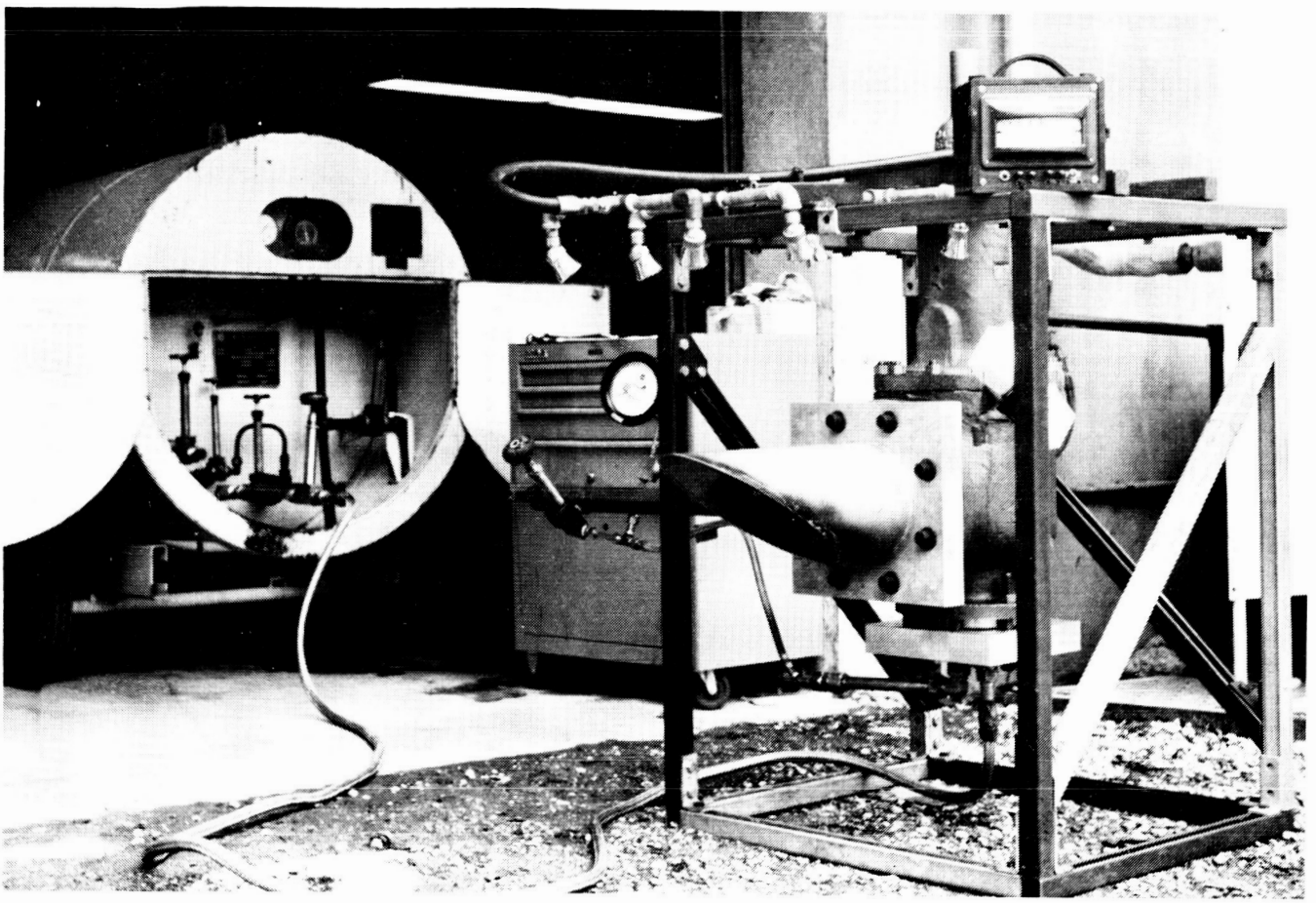


Figure 3-4. Simulated Rainfall Test Setup

SECTION IV

HIGH TEMPERATURE TEST

4.1 TEST REQUIREMENTS

4.1.1 The specimen shall be placed in the temperature test chamber and subjected to a temperature of 160 (+4, -0)°F for 72 (+2, -0) hours. A relative humidity of 20 (±5) percent shall not be exceeded. Maximum temperature change rate shall be 1°F per minute.

4.1.2 A functional test shall be performed with the specimen at operating temperature while the chamber temperature is maintained.

4.1.3 The specimen shall be visually inspected and functionally tested within 1 hour following establishment of ambient condition.

4.2 TEST PROCEDURE

4.2.1 Each specimen was installed as shown in figures 3-1 and 4-1 using the equipment listed in table 4-1.

4.2.2 All connections were tight, all gages were installed and operating properly and all hand valves were closed.

4.2.3 The chamber temperature was increased to 160°F at a rate of 1°F per minute. A relative humidity of 20 per cent was maintained.

4.2.4 The temperature and relative humidity specified in 4.2.3 were maintained for 72 hours.

4.2.5 A functional test was performed while maintaining chamber temperature and relative humidity as specified in 4.2.3.

4.2.6 After 72 hours the chamber temperature was returned to ambient conditions.

4.2.7 The specimen was functionally tested following establishment of ambient conditions.

4.3 TEST RESULTS

Each specimen demonstrated satisfactory performance during and after the high temperature environment. There was no detectable deviation in cracking or reseating pressures as a result of the test. There was no leakage during or after the test.

4.4 TEST DATA

The data presented in tables 4-2 and 4-3 were recorded during and after the high temperature environment.

SECTION IV

HIGH TEMPERATURE TEST

4.1 TEST REQUIREMENTS

4.1.1 The specimen shall be placed in the temperature test chamber and subjected to a temperature of 160 (+4, -0)°F for 72 (+2, -0) hours. A relative humidity of 20 (±5) percent shall not be exceeded. Maximum temperature change rate shall be 1°F per minute.

4.1.2 A functional test shall be performed with the specimen at operating temperature while the chamber temperature is maintained.

4.1.3 The specimen shall be visually inspected and functionally tested within 1 hour following establishment of ambient condition.

4.2 TEST PROCEDURE

4.2.1 Each specimen was installed as shown in figures 3-1 and 4-1 using the equipment listed in table 4-1.

4.2.2 All connections were tight, all gages were installed and operating properly and all hand valves were closed.

4.2.3 The chamber temperature was increased to 160°F at a rate of 1°F per minute. A relative humidity of 20 per cent was maintained.

4.2.4 The temperature and relative humidity specified in 4.2.3 were maintained for 72 hours.

4.2.5 A functional test was performed while maintaining chamber temperature and relative humidity as specified in 4.2.3.

4.2.6 After 72 hours the chamber temperature was returned to ambient conditions.

4.2.7 The specimen was functionally tested following establishment of ambient conditions.

4.3 TEST RESULTS

Each specimen demonstrated satisfactory performance during and after the high temperature environment. There was no detectable deviation in cracking or reseating pressures as a result of the test. There was no leakage during or after the test.

4.4 TEST DATA

The data presented in tables 4-2 and 4-3 were recorded during and after the high temperature environment.

Table 4-1. High Temperature Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Manning, Maxwell, and Moore	Type 1905 AC/L3	TB 95278 TB 95279	6- by 8-inch relief valve
2	Pressure Gage	Marsh	NA	95-1138B	0-to 100 psig ±0.5% FS Cal date 11/9/66
3	Hand Valve	Control Components	ES-612-T	NA	1-inch
4	Pressure Regulator	Stockham	LPC-400	NA	300-psig inlet 150-psig outlet
5	Hand Valve	Control Components	ES-608-P	NA	1/2-inch
6	GN_2 Supply	Laboratory Source	NA	NA	
7	Pressure Gage	Marsh	NA	95-1121-B	0-to 100-psig ± 0.5% FS Cal date 11/9/66
8	Hand Valve	Grove	N-3	NA	1/4-inch
9	Thermocouple	Honeywell	NA	NA	Copper constantan
10	Graduated Cylinder	NA	NA	NA	
11	High Temperature Chamber	Conrad	NA	200394	

Table 4-2. High Temperature Functional Test Data

	Specimen 1					Specimen 2				
Cracking Pressure (psig)	45	45	45	45	45	45	44	45	45	44
Reseating Pressure (psig)	44	44	43	43	44	43	43	44	44	43
Leakage at 35 psig	0	0	0	0	0	0	0	0	0	0

Table 4-3. Post-High Temperature Functional Test Data

	Specimen 1					Specimen 2				
Cracking Pressure (psig)	45	44	45	44	44	45	44	45	45	45
Reseating Pressure (psig)	44	43	44	43	44	44	43	43	44	44
Leakage at 35 psig	0	0	0	0	0	0	0	0	0	0

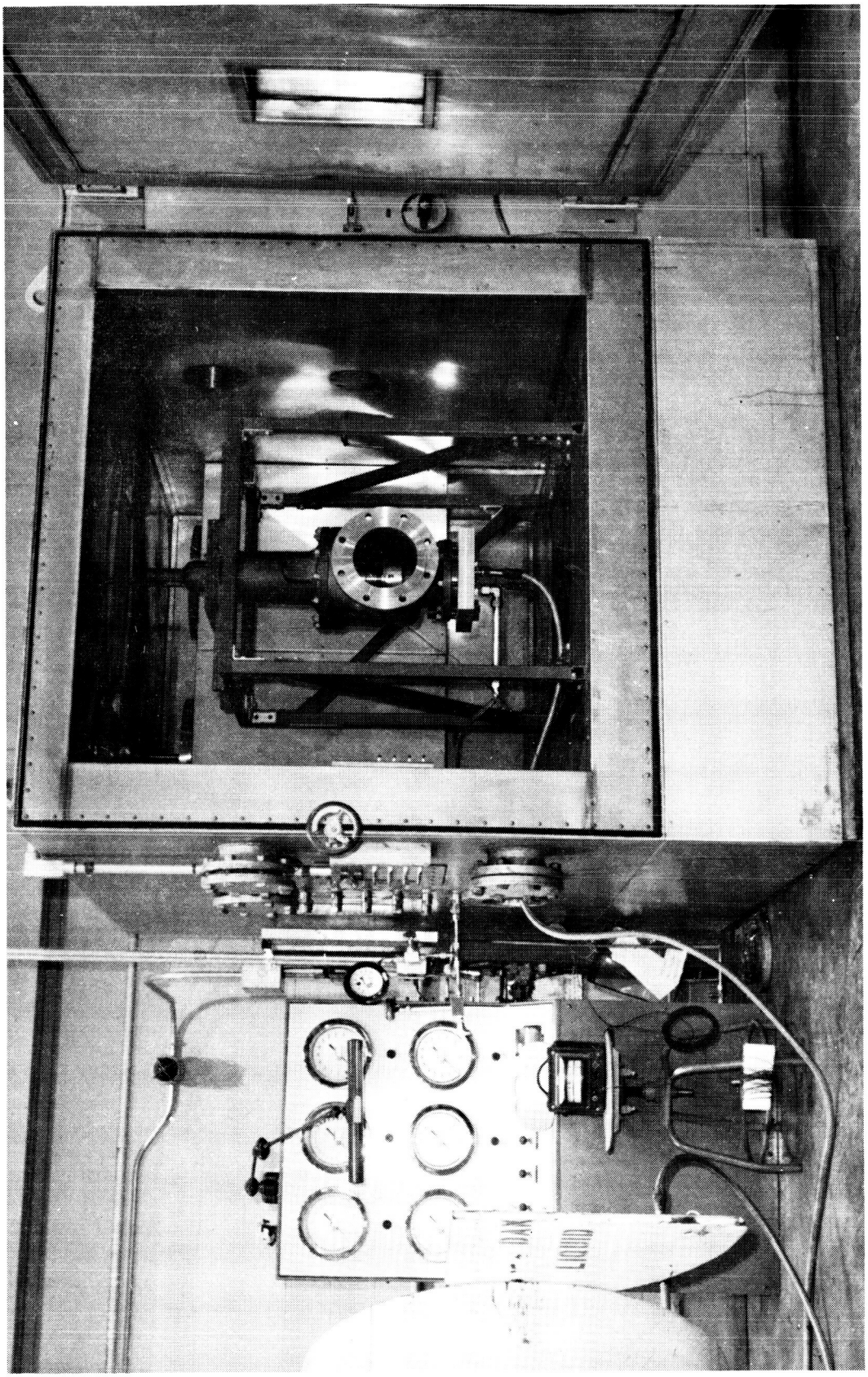


Figure 4-1. High Temperature Test Setup

SECTION V

FLOW TEST

5.1 TEST REQUIREMENTS

A curve shall be developed for flow of GN_2 at -300°F versus inlet pressures between cracking pressure and 110 per cent of cracking pressure.

5.2 TEST PROCEDURE

5.2.1 Specimen 1 was installed in the high flow test setup as shown in figures 5-1 and 5-2 using the equipmented listed in table 5-1.

5.2.2 All connections were tight and all gages were installed and operating properly.

5.2.3 Remote control valve 13 was opened and GN_2 from source 9 was allowed to flow through the specimen at 110 per cent of cracking pressure.

5.2.4 Remote control valve 8 was opened, allowing LN_2 to enter the system. Remote control valve 8 was adjusted until GN_2 at -300°F was indicated by temperature indicator 7.

5.2.5 With the flow stabilized at -300°F and at 110 per cent of cracking pressure, data indicated by instruments 2, 3, 4, 6, and 7 were recorded on oscillograph 10.

5.2.6 The pressure was decreased in increments until reseat pressure was obtained. Flow was stabilized at each increment and data indicated by instruments 2, 3, 4, 6, and 7 recorded.

5.2.7 Remote Control valves 8 and 13 were closed. Remote control valve 11

was opened. The flow at each pressure setting was computed.

5.2.8 Specimen 2 was installed as shown in figure 5-1 except that a 500 cubic foot ullage tank was used at the specimen inlet.

5.2.9 GN_2 at ambient temperature was flowed into the tank until the specimen relieved, then flow was increased until the tank pressure was 50 psig. Flow was then reduced until the specimen reseated.

5.3 TEST RESULTS

5.3.1 Flow test results of specimen 1 were considered satisfactory for determining the relief capacity of the valve. Relief capacity was determined to be 34.8 pounds per second at an inlet pressure of 51 psig.

5.3.2 Flow test results of specimen 2 were considered satisfactory for determining if valve chatter would occur with an ullage tank at the valve inlet. Specimen operation during the test was smooth from cracking through reseating. There was no evidence of valve chatter or seat damage.

5.4 TEST DATA

The flow test data is presented graphically in figure 5-3.

The data presented in table 5-3 were recorded during the post flow test functional on specimen 1.

Table 5-1. Flow Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Manning, Maxwell, and Moore	Type 1905 AC/L3	TB 95278 TB 95279	6-by 8-inch relief valve
2	Pressure Transducer	C.E.C.	4-350-0001	3231	0-to 100-psig ±0.25% FS Cal date 1/6/67
3	Pressure Transducer	C.E.C.	4-350-0002	2798	Differential ±0.25% FS Cal date 1/6/67
4	Thermocouple	West	NA	NA	Copper constantan
5	Venturi Tube	CCSD	NA	NA	2-inch throat
6	Pressure Transducer	C.E.C.	4-350-0001	2443	0-to 100-psig ±0.25% FS Cal date 1/2/67
7	Thermocouple	Honeywell	NA	NA	Copper constantan
8	Valve	Calmec	279	NA	Remotely controlled
9	GN_2 Supply	Laboratory Supply	NA	NA	Controlled temperature and flow
10	Recording Oscillograph	C.E.C.	NA	9014	NA
11	Valve	Control Components	ES-608-P	N/A	NA
12	LN_2 Supply	CCSD	NA	NA	NA
13	Valve	Calmec	279	NA	Remotely controlled

Table 5-2. Specimen 1 Leakage (Post-Flow Functional Test) Data

Inlet Pressure (psig)	Leakage (SCFM)
10	0.9
20	1.7
25	2.2
30	3.3
35	3.5
40	4.3
42	4.8

Note: All lines $\frac{1}{4}$ inch unless otherwise indicated.
Refer to table 5-1 for item identification.

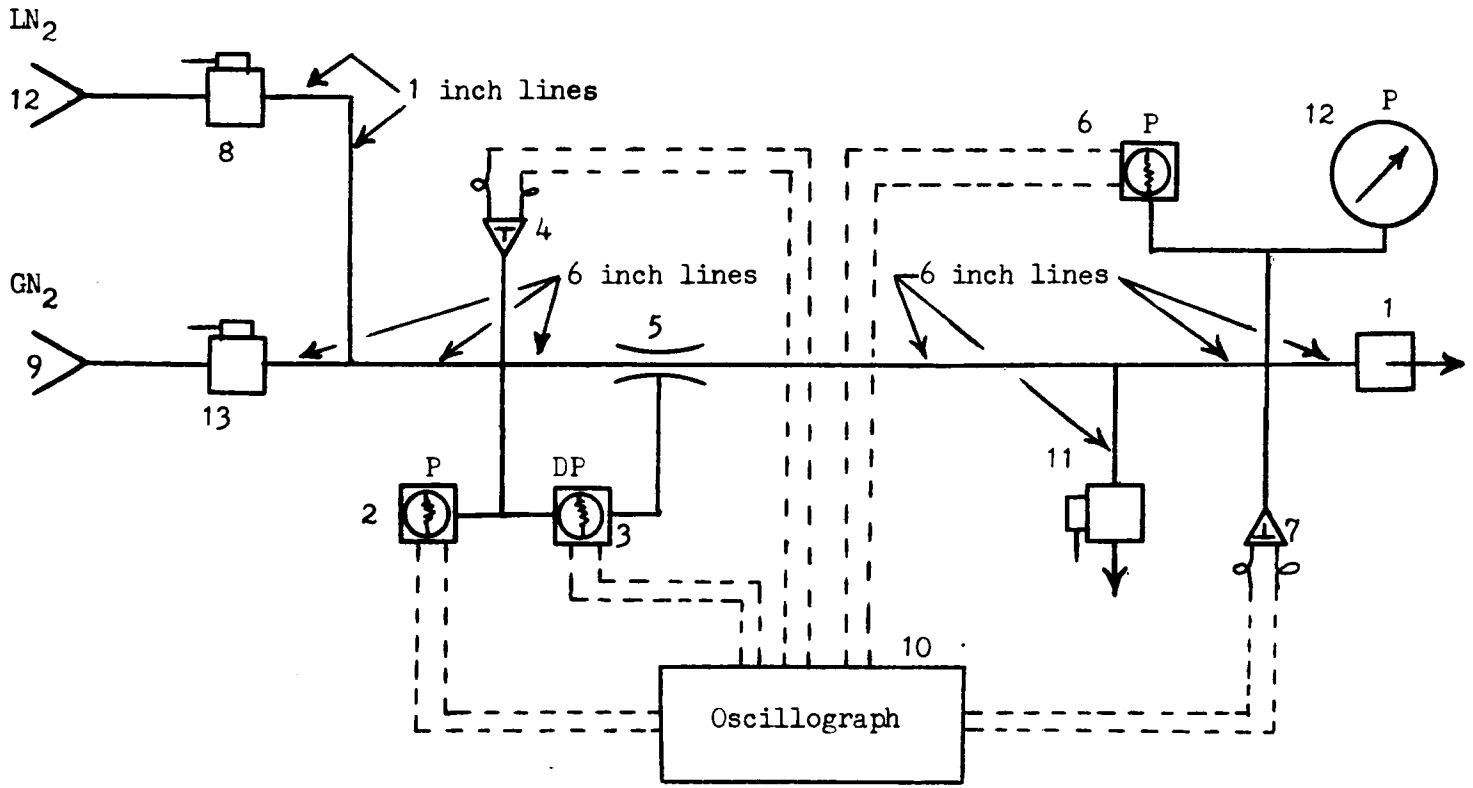


Figure 5-1. Flow Test Schematic

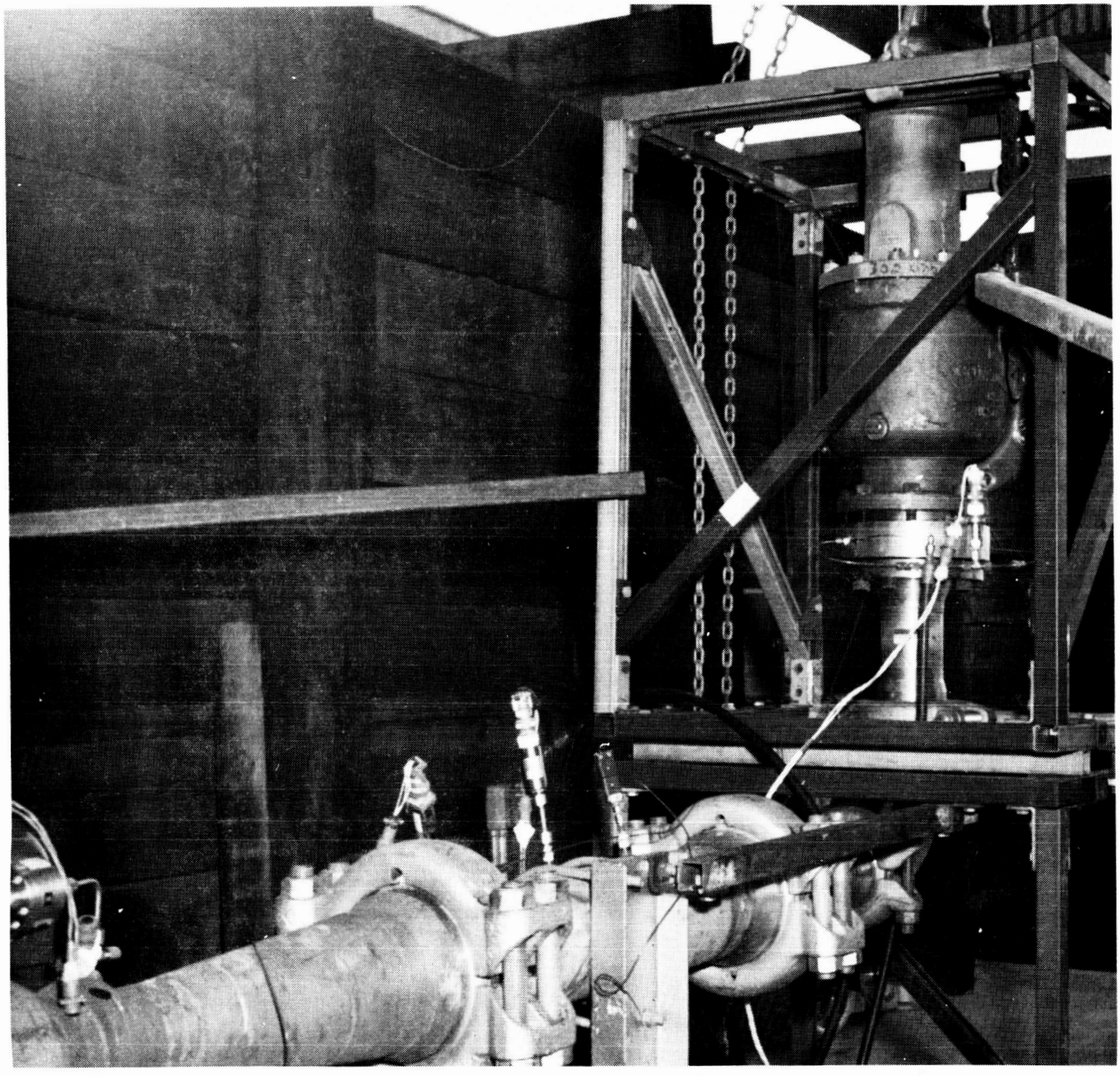


Figure 5-2. Flow Test Setup

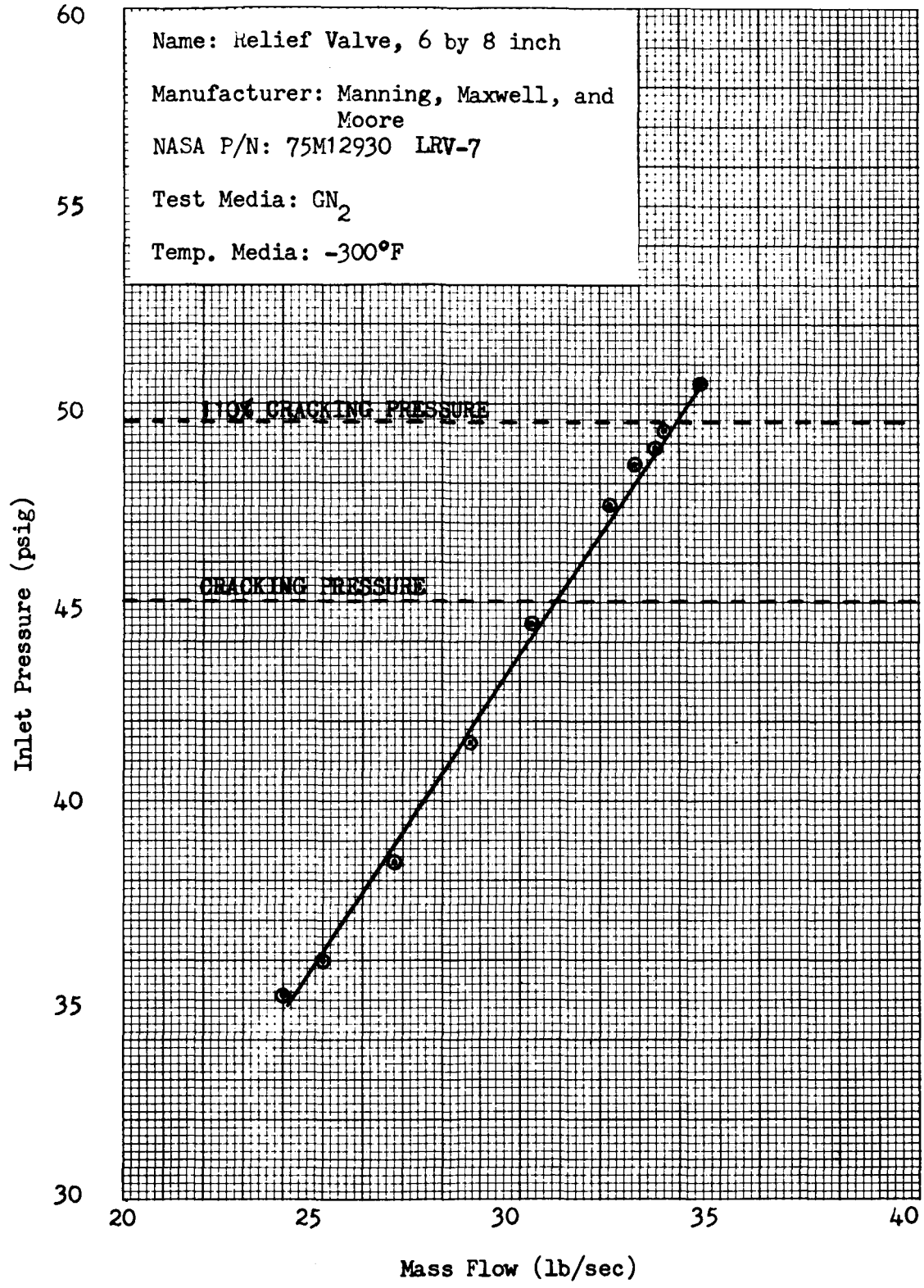


Figure 5-3. Inlet Pressure vs Mass Flow

SECTION VI

SURGE AND RESPONSE TEST

6.1 TEST REQUIREMENTS

6.1.1 The inlet port of the specimen shall be pressurized to 37 psig and the inlet pressure surged to 50 psig in as short a period as possible. The time differential between an inlet pressure of 45 psig and actual cracking of the specimen shall be recorded.

6.1.2 The procedure described in 6.1.1 shall be repeated 10 times.

6.2 TEST PROCEDURE

6.2.1 Each specimen was installed as shown in figures 6-1 and 6-2 using equipment listed in table 6-1.

6.2.2 All connections were tight, all gages were installed and operating properly, and all hand valves were closed.

6.2.3 Hand valve 3 was opened.

6.2.4 By adjusting regulator 4, the pressure was increased to 37 psig as indicated on gauge 5.

6.2.5 Solenoid valve 6 was actuated and specimen inlet pressure was allowed to stabilize at 37 psig.

6.2.6 Solenoid valve 6 was deactuated.

6.2.7 By readjusting regulator 4, the pressure was increased to 50 psig. as indicated on gauge 5.

6.2.8 Solenoid valve 6 was actuated and the time lapse between a specimen inlet pressure of 45 psig and actual cracking of the specimen was recorded on oscillograph 12.

6.2.9 Solenoid valve 6 was deactuated and the specimen inlet pressure allowed to vent to 37 psig through relief valve 9.

6.2.10 The procedures described in 6.2.9 and 6.2.10 were repeated ten times.

6.2.11 Hand valve 3 was closed.

6.2.12 Regulator 4 was readjusted to zero outlet pressure.

6.2.13 Hand valve 8 was opened and the pressure vented to zero.

6.3 TEST RESULTS

Each specimen demonstrated satisfactory operation during and after the surge and response test. Specimen response was considered satisfactory with cracking occurring within 100 milliseconds after cracking pressure was reached.

6.4 TEST DATA

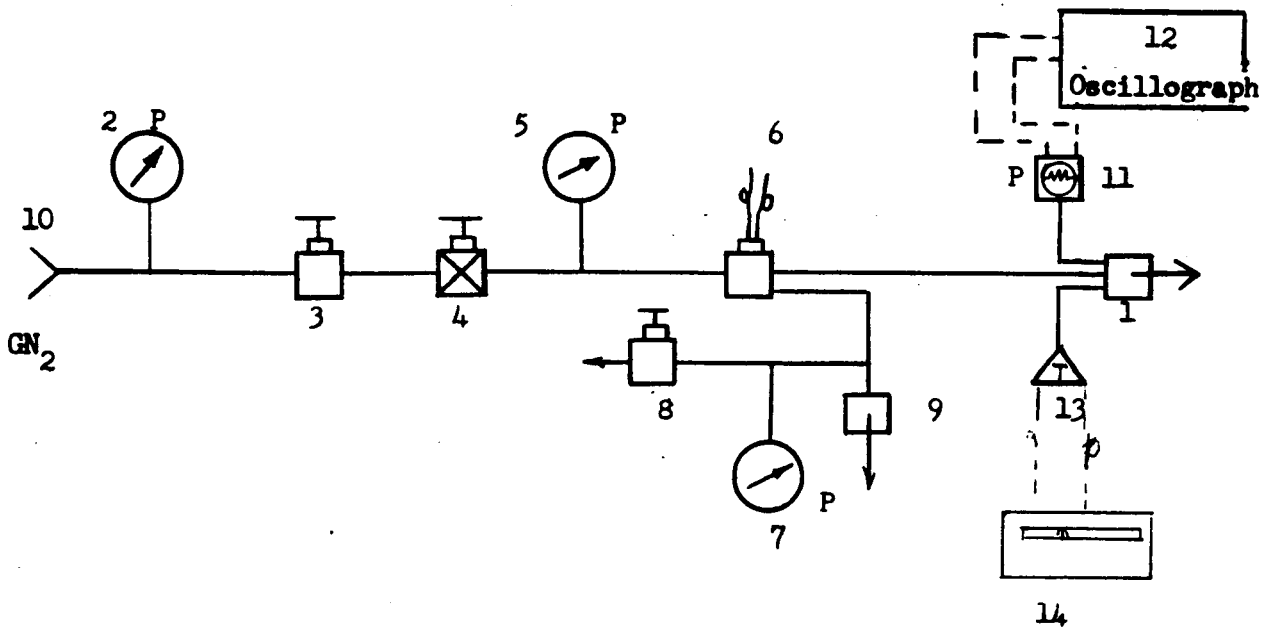
The data presented in table 6-2 and figure 6-3 were recorded during and after the surge and response test.

Table 6-1. Surge and Response Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Manning, Maxwell, and Moore	Type 1905 QC/L3	TB 95279 TB 95280	6- by 8-inch relief valve
2	Pressure Gage	U.S. Gauge	NA	12077-1	0-to 300-psig ±0.25% FS Cal date 11/10/66
3	Hand Valve	Stockham	NA	E5-612-PT	1-inch
4	Pressure Regulator	Stockham	400w	NA	300-psig inlet 150-psig outlet
5	Pressure Gage	Marsh	NA	95-1138-B	0-to 100-psig ±0.25% FS Cal date 11/10/66
6	Solenoid Valve	ASCO	NA	70335N	½-inch, 28-vdc
7	Pressure Gage	Marsh	NA	95-1121-13	0-to 100-psig ±0.25% FS Cal date 11/28/66
8	Hand Valve	Stockham	NA	E5-610P	1/4-inch
9	Relief Valve	Control Components	E5-608-T	NA	1/4-inch adjustable
10	GN_2 Supply	Laboratory Source	NA	NA	
11	Pressure Transducer	CEC	4-350-0001	3231	0-to 100-psig ±0.25% FS Cal date 11/9/66
12	Recording Oscillograph	CEC	NA	012578	
13	Thermocouple	Honeywell	NA	65090901	Copper constantan
14	Temp. Indicator	West	NA	08-113-95-135013	cal date 11/9/66

Table 6-2. Post-Surge Functional Test Data

	Specimen 2					Specimen 3				
Cracking Pressure (psig)	45	45	45	45	45	45	45	46	45	45
Reseating Pressure (psig)	44	43	44	44	44	44	44	45	44	44
Leakage at 35 psig	0	0	0	0	0	0	0	0	0	0



Note: All lines 1/2 inch.
Refer to table 6-1 for item identification.

Figure 6-1. Surge and Response Test Schematic

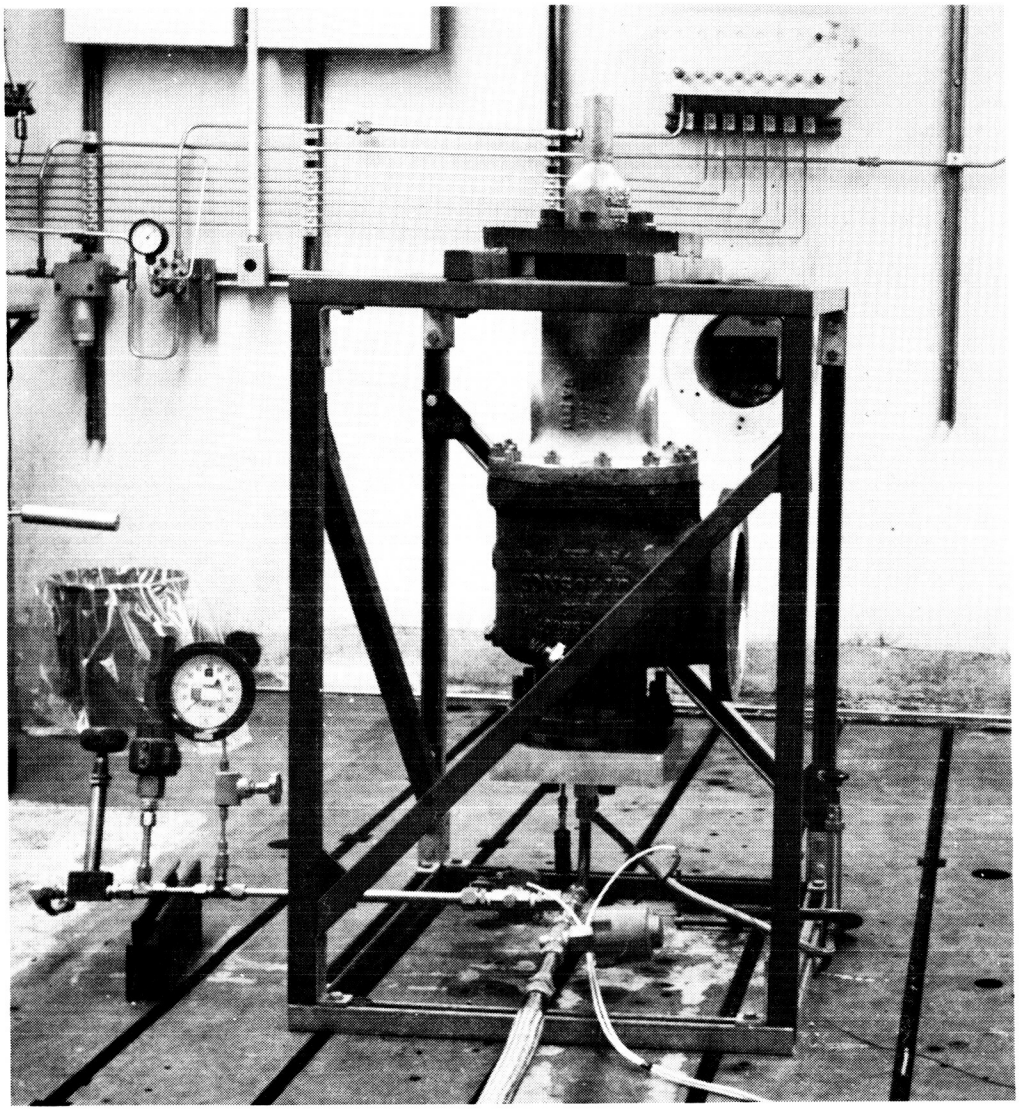


Figure 6-2. Surge, Response and Cycle Test Setup

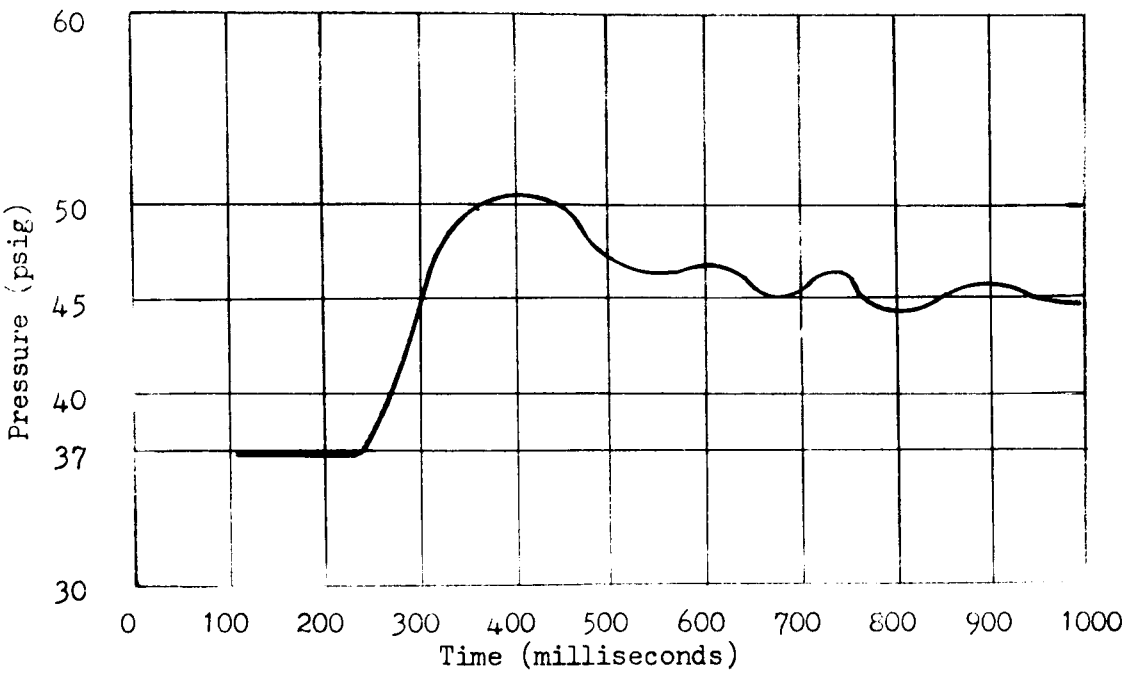


Figure 6-3. Typical Valve Response Trace

SECTION VII

CYCLE TEST

7.1 TEST REQUIREMENTS

7.1.1 The specimen inlet port shall be pressurized to 105 per cent of the cracking pressure and held for a minimum of 1 second. The pressure shall then be returned to 37 psig and held for a minimum of 5 seconds. This shall constitute one cycle. Perform 1000 cycles.

7.1.2 A functional test shall be performed after 50, 100, 200, 500, and 1000 cycles.

7.2 TEST PROCEDURE

7.2.1 Each specimen was installed as shown in figures 7-1 and 6-2 using equipment listed in table 7-1.

7.2.2 All connections were tight, all gages were installed and operating properly, and all hand valves were closed.

7.2.3 Hand valve 3 was opened.

7.2.4 By adjusting regulator 4, the pressure was increased until 105 per cent of cracking pressure was indicated on gauge 5.

7.2.5 Solenoid valve 6 was actuated with timer 7. Timer 7 was adjusted so that 105 per cent of cracking pressure was held for 1 second and 37 psig was held for 5 seconds. Pressurization from 37 psig to 105 per cent of cracking pressure and venting to 37 psig constituted 1 cycle.

7.2.6 A temperature of -300°F for GN_2 flowing through the specimen was maintained.

7.2.7 1000 cycles were completed.

7.2.8 By readjusting regulator 4, the pressure indicated on gauge 5 was reduced to zero.

7.2.9 Hand valve 3 was closed.

7.2.10 Specimen pressure was vented to zero psig by opening hand valve 9.

7.2.11 A functional test was performed after 50, 100, 500, and 1000 cycles.

7.3 TEST RESULTS

Test results were considered satisfactory. There was no detectable change in cracking or reseating pressures for either specimen as a result of the cycle test. No leakage was observed during functional testing.

7.4 TEST DATA

Test data recorded during and after the test are presented in tables 7-2 through 7-6.

Table 7-1. Cycle Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Manning, Maxwell and Moore	Type 1905 AC/C3	TB 95278 TB 95280	6-to 8-inch relief valve
2	Pressure Gage	Marsh	NA	95-1138-B	0-to 100-psig ±0.25% FS Cal date 10/11/66
3	Hand Valve	Stockham	NA	E5-612-PT	1-inch
4	Pressure Regulator	Stockham	400w	NA	300-psig inlet 150-psig outlet
5	Pressure Gage	Marsh	NA	95-1121-B	0-to 100-psig ±0.25% FS Cal date 11/28/66
6	Solenoid Valve	ASCO	NA	70335N	1/2-inch, 28-vdc
7	Timer	Wilson Co.	A-410	NA	
8	Counter	Durant	NA	95-1108-B	
9	Hand Valve	Stockham	NA	E5-610-P	1/4-inch
10	Pressure Gage	Marsh	NA	95-1131-B	0-to 100-psig ±0.25% FS Cal date 11/22/66
11	Relief Valve	Control Components	ES-608-T	NA	1/4-inch adjustable pressure outlet
12	Thermocouple	Honeywell	NA	65090909	Copper constantan
13	GN_2 Supply	Laboratory Source	NA	NA	
14	Temp. Indicator	West	NA	08-113 95-1350B	cal date 11/9/66

Table 7-2. Post-50 Cycle Functional Test Data

	Specimen 2					Specimen 3				
Cracking Pressure (psig)	45	45	45	45	45	46	46	45	46	46
Reseating Pressure (psig)	44	43	44	44	43	44	45	44	44	44
Leakage at 35 psig	0	0	0	0	0					

Table 7-3. Post-100 Cycle Functional Test Data

	Specimen 2					Specimen 3				
Cracking Pressure (psig)	45	44	45	45	45	46	45	45	46	45
Reseating Pressure (psig)	43	43	44	44	44	44	44	45	45	44
Leakage at 35 psig	0	0	0	0	0	0	0	0	0	0

Table 7-4. Post-200 Cycle Functional Test Data

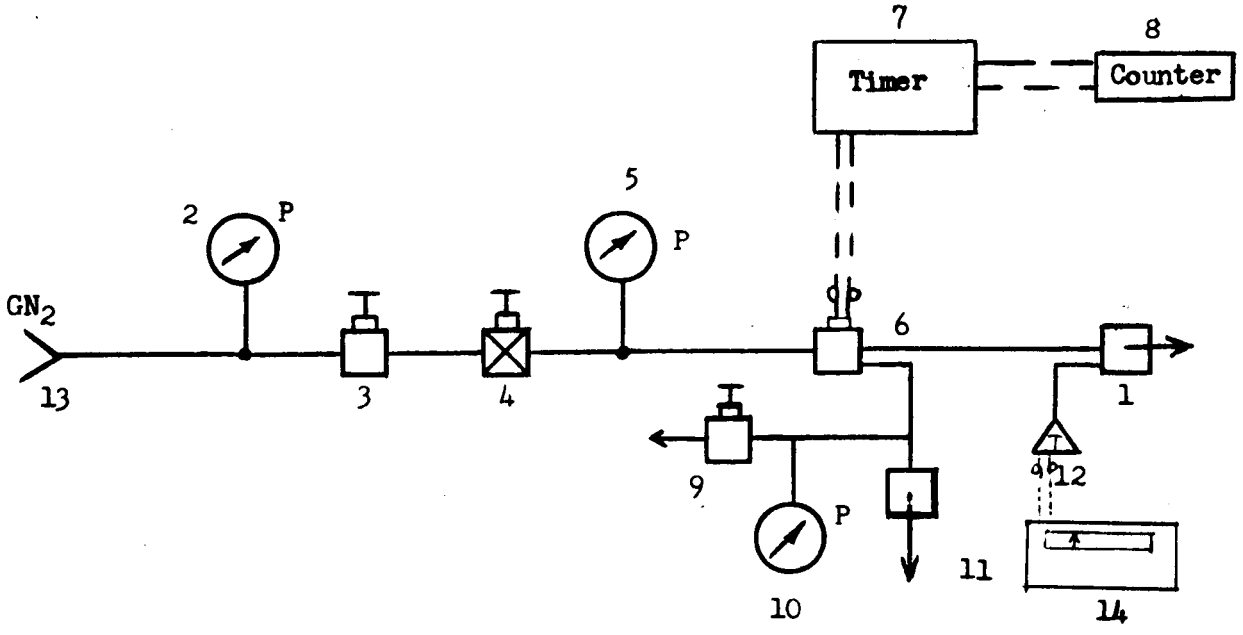
	Specimen 2					Specimen 3				
Cracking Pressure (psig)	45	44	44	45	45	46	45	46	46	45
Reseating Pressure (psig)	44	44	44	44	44	45	44	44	44	44
Leakage at 35 psig	0	0	0	0	0	0	0	0	0	0

Table 7-5. Post-500 Cycle Functional Test Data

	Specimen 2					Specimen 3				
Cracking Pressure (psig)	45	45	45	45	45	45	46	45	46	46
Reseating Pressure (psig)	44	44	44	43	43	44	44	44	45	44
Leakage at 35 psig	0	0	0	0	0	0	0	0	0	0

Table 7-6. Post-1000 Cycle Functional Test Data

	Specimen 2					Specimen 3				
Cracking Pressure (psig)	45	44	44	45	45	45	45	46	45	45
Reseating Pressure (psig)	44	44	43	43	43	44	44	45	44	44
Leakage at 35 psig	0	0	0	0	0	0	0	0	0	0



Note: All lines 1/2 inch.
Refer to table 7-1 for item identification.

Figure 7-1. Cycle Test Schematic

SECTION VIII

PROOF PRESSURE TEST

8.1 TEST REQUIREMENTS

8.1.1 The inlet and outlet ports of the specimen shall be pressurized simultaneously with deionized water to 68 psig (± 5 psig). This pressure shall be maintained for 30 minutes.

8.1.2 The specimen shall be inspected for leakage and for distortion.

8.2 TEST PROCEDURE

8.2.1 Each specimen was installed as shown in figures 8-1 and 8-2 using equipment listed in table 8-1.

8.2.2 All connections were tight, all gauges were installed and operating properly, and all hand valves were closed.

8.2.3 Each specimen was filled with deionized water.

8.2.4 All air was bled from lines by opening hand valves 2 and 5 and pressurizing reservoir 6.

8.2.5 Hand valve 5 was closed.

8.2.6 Using pressurized reservoir 6, the specimen pressure was raised to 68 psig as indicated by gauge 3.

8.2.7 Hand valve 2 was closed.

8.2.8 Pressure was maintained for 30 minutes.

8.2.9 Each specimen was inspected for leakage and for distortion.

8.2.10 Hand valve 5 was opened and water pressure relieved.

8.3 TEST RESULTS

Test results were considered satisfactory. No external leakage of distortion was detected during the test.

8.4 TEST DATA

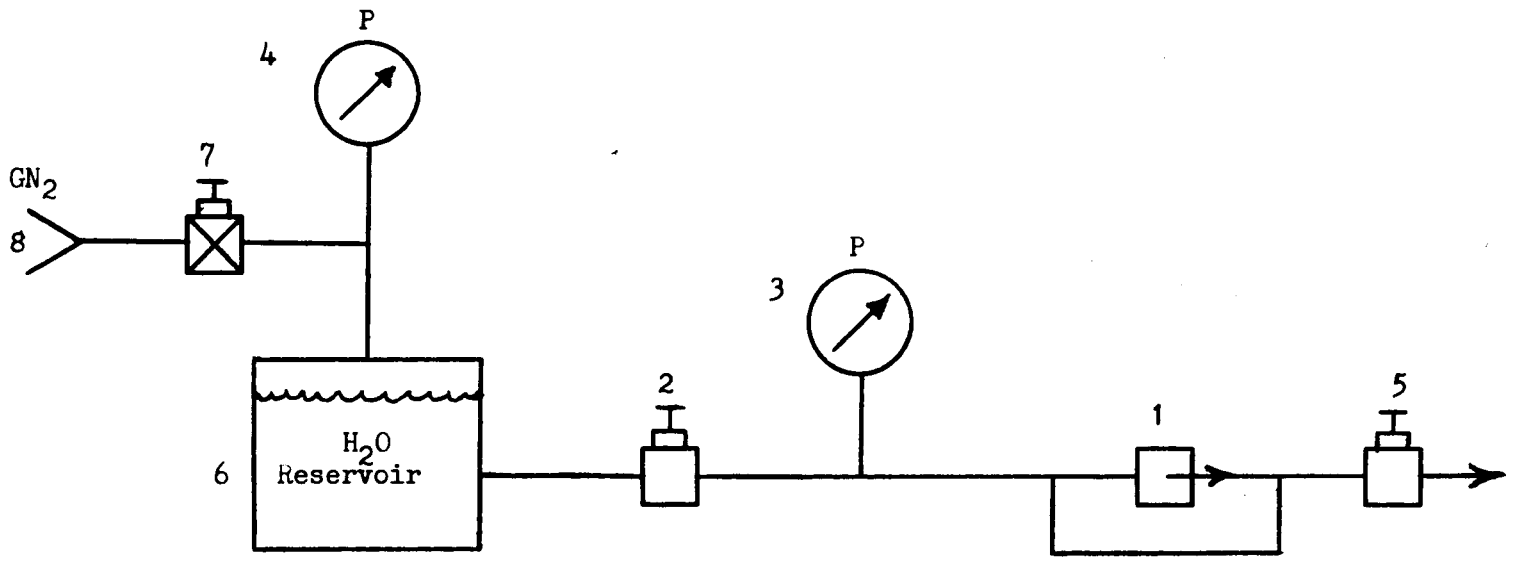
The data presented in table 8-2 were recorded during the test.

Table 8-1. Proof Pressure Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Manning, Maxwell, and Moore	Type 1905 QC/L3	TB 95278 TB 95279 TB 95280	6-by 8-inch relief valve
2	Hand Valve	Grove	M-14918	NA	1/4-inch
3	Pressure Gage	Marsh	NA	95-1121-B	0-to 100-psig ±0.25% FS Cal date 11/28/66
4	Pressure Gage	Marsh	NA		0-to 100-psig ±0.25% FS Cal date 11/22/66
5	Hand Valve	Marsh	1936FFG	NA	1/4-inch
6	H_2O Reservoir	CCSD	NA	NA	
7	Regulator	Tescom	26-0121-0	NA	
8	GN_2 Supply	Laboratory Source	NA	NA	

Table 8-2. Proof Pressure Test Data

	Specimen 1	Specimen 2	Specimen 3
Pressure (psig)	68	68	68
Time (minutes)	30	30	30
Leakage	0	0	0
Distortion	None	None	None



Note: All lines $\frac{1}{4}$ inch.
Refer to table 8-1 for item identification.

Figure 8-1. Proof Pressure Test Schematic

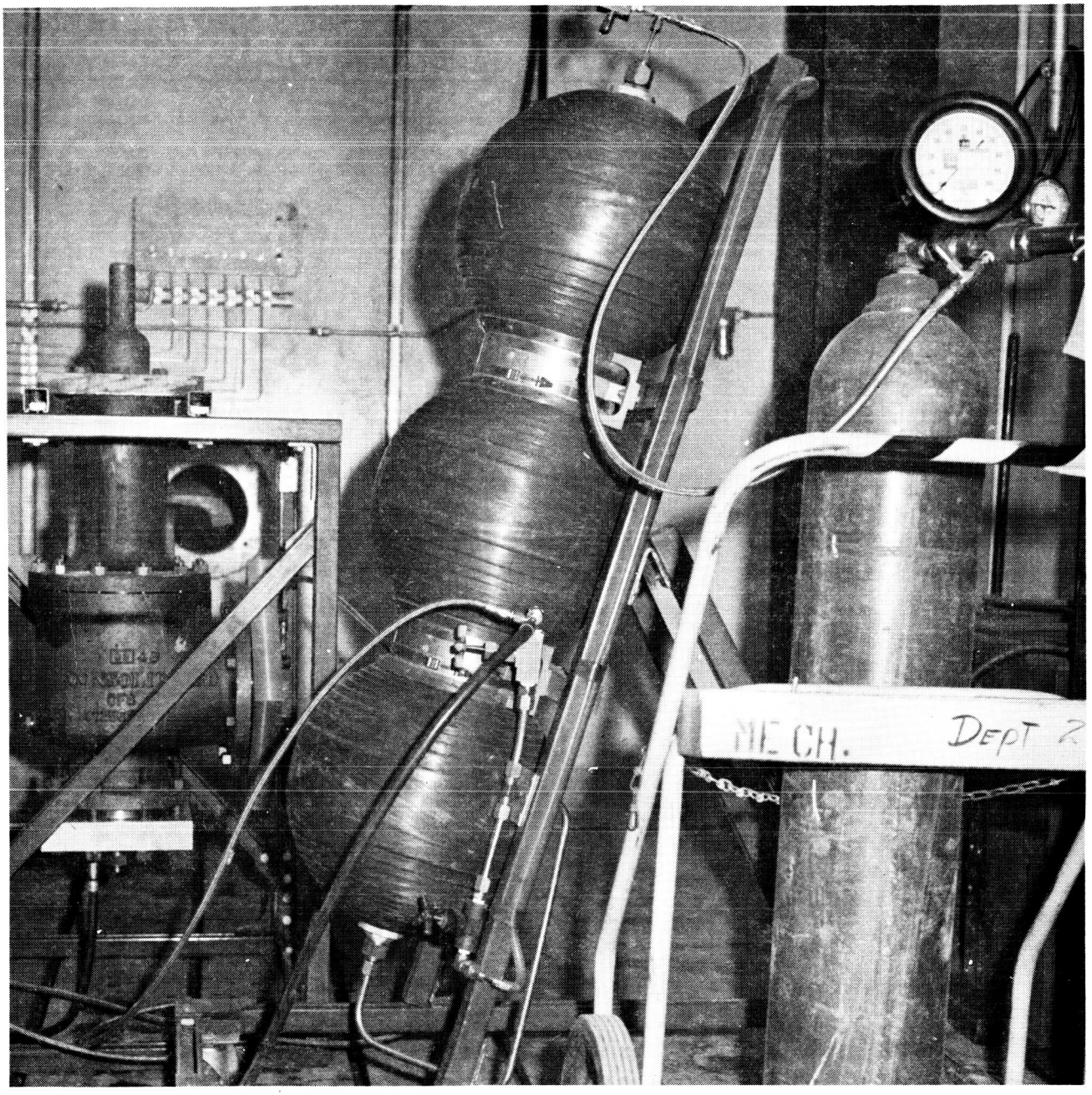


Figure 8-2. Proof Pressure Test Setup

APPROVAL

TEST REPORT

FOR

RELIEF VALVE, 6 BY 8 INCH

Manning, Maxwell, and Moore Part Number Type 1905 AC/L3

NASA Drawing Number 75M12930 LRV-7

SUBMITTED BY:

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